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Systematic account of diverse sponge species

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ABSTRACT

Underwater surveys were conducted in six study locations *viz*., Enayam, Adimalathura, Vizhinjam, Varkala, Odayam and Paravoor to record the diversity of sponges. A total of 24 species of sponges was identified during the study which belonged to 20 genera, 14 families and 6 orders. Maximum species diversity was recorded at Enayam (11 species), followed by an equal number of species at Vizhinjam and Adimalathura (10 species each). Five species of sponges were recorded at Odayam while three species were recorded at Varkala and only one at Paravoor. The present study has indicated that the stations Enayam, Vizhinjam and Adimalathura are rich in diversity of sponges as compared to Varkala, Odayam and Paravoor as is evident from the Shannon diversity index and the dominance plot. A systematic account of all the 24 species of sponges recorded during the study has been described with salient illustrations in this chapter.

Keywords: *Marine sponges, Distribution, Diversity, Southern India*

Introduction

The sponges are important components of coral reefs having both ecological and commercial significance. They are the oldest Parazoans still extant and their continued existence in vast numbers is closely linked to the apparent adaptability to changes in environmental characteristics and competing biota (Bergquist, 1978; Muller, 2003). They are also known to be effective filter-feeders and some of them are also capable of bio-eroding as well as consolidating reef structures (Hooper, 2000).

The sponges have become the focus of biochemical studies due to the presence of novel compounds and bioactive secondary metabolites which might turn out to be a cure for many diseases, including cancer. Some sponges like *Aplysina fulva* and *Mycale microsigmatosa* have the potential to prevent marine biofouling (Pereira *et al*., 2002).

A total of 9,083 valid species of sponges are enlisted in the World Porifera Database (Van Soest *et al*., 2018); however, it is believed that there could be more species. The coral reef areas in the Indian waters are rich in sponge fauna and a total of 486 species of marine sponges have so far been described from the Indian waters (Thomas, 1998). Intensive field surveys in the hitherto unexplored areas may result in the discovery of many new species that were not reported earlier. This Chapter presents the distribution and diversity of sponge resources from Enayam to Kollam, a less explored patchy coral area of southern India and an attempt has been made to provide a systematic account of all the species of sponges recorded during the study.

Materials and methods

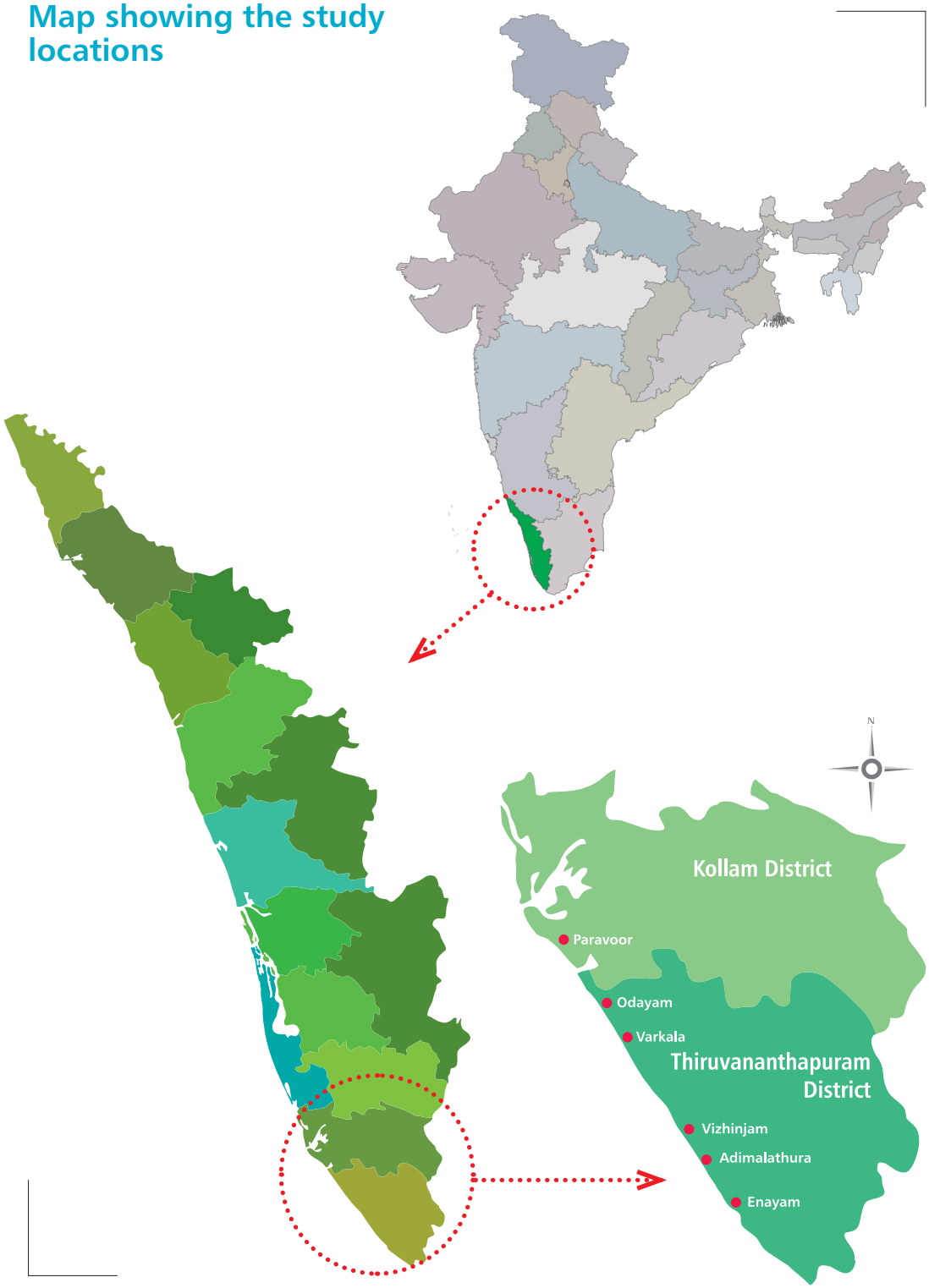
Underwater surveys were conducted by scuba diving in six different study locations *viz*., Enayam, Adimalathura, Vizhinjam, Varkala, Odayam and Paravoor where patchy coral growths are present. The surveys were conducted in shallow waters in depths ranging from 10 to 30 m. Table 1 gives the description of the study locations.

Surveys were carried out in all the study stations to record the diversity of sponges along the coast. The sponge samples collected were coded for later identification in the laboratory and the number of each species collected was recorded. Underwater photographs of the reef area and the associated sponge fauna were also taken. The samples were brought to the laboratory in clean polythene bags; one sample per bag. The specimens were photographed immediately after reaching the laboratory.

Table 1. Brief description of the study area

Station No.	Location	Position		Remarks
		°N Latitude	°E Longitude	
1.	Enayam	08°12′	77°10′	Reefs with abundant brown mussel population; many sponges were found attached to the brown mussels.
2.	Vizhinjam	08°22′	77°65′	Reefs with abundant brown mussel population; many sponges were found attached to the brown mussels.
3.	Adimalathura	08°21′	77°00′	Reefs with abundant brown mussel population; many sponges were found attached to the brown mussels.
4.	Varkala	08°44′	76°41′	Sparse small patches of corals.
5.	Odayam	08°44′	76°41′	Sparse small patches of corals.
6.	Paravoor	08°48′	76°38′	Sparse small patches of corals.

Map showing the study locations



The morphological characteristics of each specimen including size, shape, colour, texture, maximum height, breadth and oscule diameter were noted. The specimens were then individually preserved in 90% alcohol for identification to the species level. For identification, samples from different portions of the sponge specimen were carefully removed using a fine razor blade and digested separately using concentrated nitric acid for extraction of sclerites. The sclerites were microscopically examined and measured using Image Analysis Software (Scopephoto-Catcam). The specimens were identified using the taxonomic keys described by de Laubenfels (1936; 1948) and Thomas (1986).

The biodiversity indices were calculated using PRIMER (v6). The diversity of sponges was calculated employing the Shannon-Weiner Index (H') and Pielou's Evenness Index (J'). The diversity of sponges between stations was compared by drawing the dominance plot. Variations in the sponge community structure between the stations were examined using hierarchical cluster analysis.

Results and discussion

A total of 24 species of sponges was identified and described and the species recorded belonged to 20 genera, 14 families and 6 orders. A synoptic list of the sponge species is given in table 2, followed by a detailed description of all the 24 sponge species identified during the present study.

Table 2. Synoptic list of sponge species recorded from Enayam to Kollam

Classification:
Phylum Porifera Grant
Class Demospongiae Sollas
Order KERATOSIDA Grant
Family Spongiidae Gray
Genus *Ircinia* Nardo
Ircinia fusca (Carter)
Genus *Spongia* Linnaeus
***Spongia* sp**.
Order HAPLOSCLERIDA Topsent
Family Adociidae de Laubenfels
Genus *Sigmadocia* de Laubenfels
Sigmadocia carnosa (Dendy)
Genus *Toxadocia* de Laubenfels
Toxadocia toxius (Topsent)
Genus *Petrosia* Vosmaer
Petrosia similis Ridley and Dendy
Family Callyspongiidae de Laubenfels
Genus *Callyspongia* Duchassaing and Michelotti
Callyspongia diffusa (Ridley)
Callyspongia fibrosa (Ridley and Dendy)
Callyspongia reticutis* var. *salomonensis Dendy
Order POECILOSCLERIDA Topsent
Family Plocamiidae Topsent
Genus *Plocamilla* Topsent
Plocamilla mannarensis (Carter)
Family Myxillidae Dendy
Genus *Myxilla* Schmidt
Myxilla arenaria Dendy
Family Raspailiidae Hentschel
Genus *Aulospongus* Norman
Aulospongus tubulatus (Bowerbank)
Genus *Endectyon* Topsent
Endectyon fruticosa (Dendy)
Family Ophlitaspongiidae de Laubenfels
Genus *Clathria* Schmidt
Clathria frondifera (Bowerbank)
Clathria procera (Ridley)
Genus *Mycale* Gray
Mycale mytilorum Annandale
Genus *Zygomycale* Topsent
Zygomycale parishii (Bowerbank)
Family Microcionidae Henteschel
Genus *Aulenella* Burton & Rao
Aulenella foraminifera Burton & Rao

Order HALICHONDRIDA Gray
Family Axinellidae Carter
Genus *Axinella* Schmidt
Axinella donnani (Bowerbank)
Family Halichondridae Gray
Genus *Trachyopsis* Dendy
Trachyopsis halichondroides Dendy
Order HADROMERIDA Topsent
Family Clionidae Gray
Genus *Cliona* Grant
Cliona celata Grant
Cliona vastifica Hancock
Family Suberitidae Schmidt
Genus *Pseudosuberites* Topsent
Pseudosuberites andrewsi Kirkpatrick
Order EPIPOLASIDA de Laubenfels
Family Jaspidae de Laubenfels
Genus *Prostylyssa* Topsent
Prostylyssa foetida (Dendy)
Family Sollasellidae Lendefeld
Genus *Epipolasis* de Laubenfels
Epipolasis topsenti (Dendy)

Ircinia fusca (Carter)

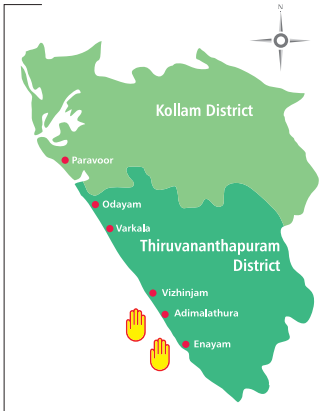
Synonyms:

Hircinia fusca Carter, 1880; Dendy, 1905. *Ircinia fusca* de Laubenfels, 1948; Thomas, 1986.

Classification:

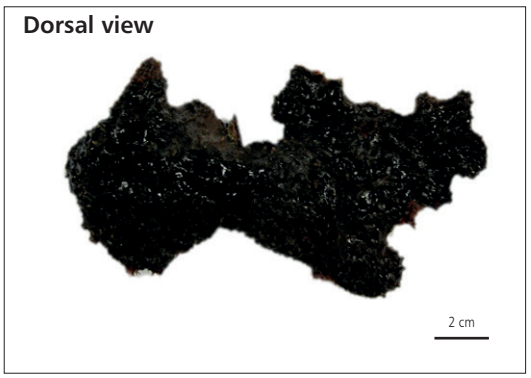
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Keratosida
Family	:	Spongiidae
Genus	:	*Ircinia*

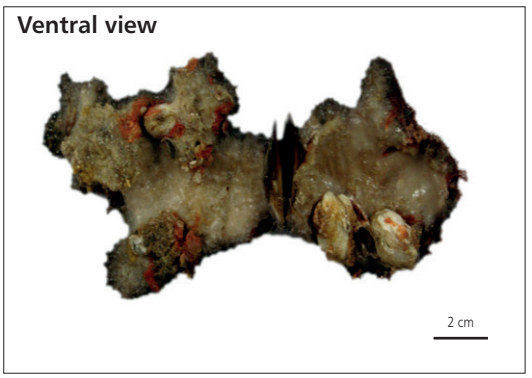
General distribution: Widely distributed in the Indo-Pacific region.
Distribution in the study area: Enayam and Adimalathura

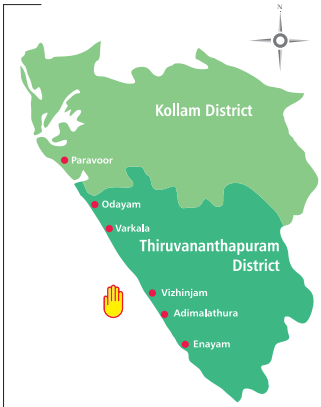


Characteristic features:

- Maximum width of specimen: 72 mm.
- Maximum height of specimen: 60 mm.
- Colour: blackish-brown externally and pale yellow internally when alive.
- Texture: leathery and slightly compressible.
- Keratose sponge has only spongin fibres, and the genus *Ircinia* has 'ircinia filaments'.
- Sponge massive and lobate.
- Surface conulose, conules 1-3 mm high and may form ridges when arranged serially.
- Oscules scattered; oscule diameter upto 2 mm.
- Spongin fibres form a reticulation of primaries and secondaries.
- Both primaries and secondaries contain arenaceous objects in varying degrees.
- The 'ircinia filaments' are seen only in the genus *Ircinia*. The filaments are long structures and both the ends are swollen like a bulb.







Sampling site
Distribution

Spongia sp.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Keratosida
Family	:	Spongiidae
Genus	:	*Spongia*

Distribution in the study area: Vizhinjam

Characteristic features:

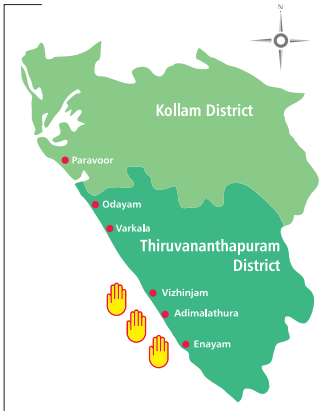
- Maximum width of specimen: 90 mm.
- Maximum height of specimen: 73 mm.
- Colour: black to purple, becoming yellow towards the base.
- Texture: compressible.
- Keratose sponge has only spongin fibres.
- Sponge massive.
- Surface minutely conulose.
- Oscules, flush with the surface or on conical projections, 2-8 mm in diameter and compound.
- Skeleton composed of a close meshed reticulation of ascending fibres or primaries connected by polygonal meshed network of slender fibres.
- Primaries are often cored by foreign objects, but connectives are devoid of any inclusion.
- Species of the genus Spongia are abundant in the tropical waters and were commercially exploited in the past.

Sigmadocia carnosa (Dendy)

Synonyms:
Gelliodes carnosa Dendy, 1889
Sigmadocia carnosa Thomas, 1986
Classification:

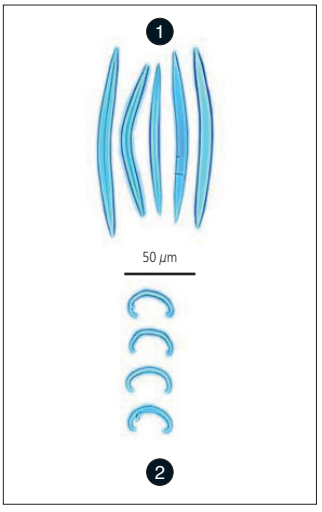
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Haplosclerida
Family	:	Adociidae
Genus	:	*Sigmadocia*

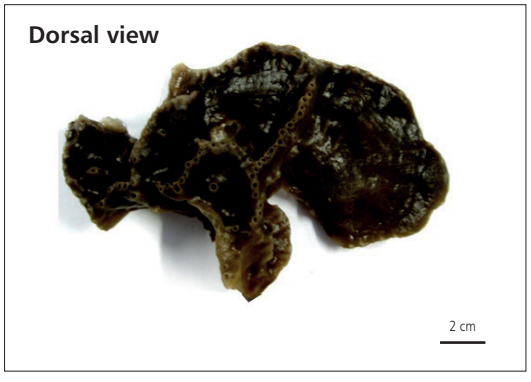
General distribution: Widely distributed in the Indian Ocean.
Distribution in the study area: Enayam, Adimalathura and Vizhinjam

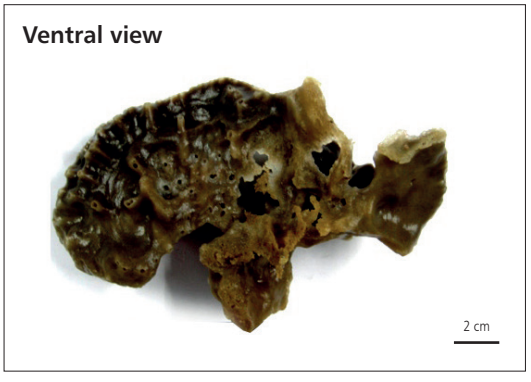


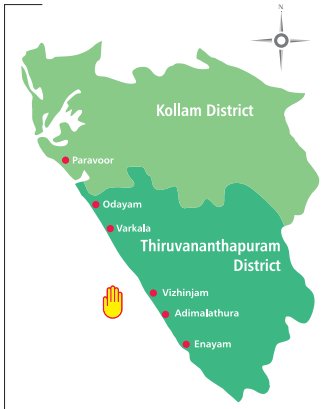
Characteristic features:
- Maximum width of specimen: 170 mm.
- Maximum height of specimen: 117 mm
- Colour: pale yellow when alive.
- Texture: compressible with good resiliency.
- Sessile, lamellate or encrusting; marginate in lamellate specimens.
- Oscules terminal and compound, diameter 1 to 2 mm.
- Dermal skeleton a well developed unispicular reticulation.

Spicules:
1. Oxeas: 0.10-0.13 x 0.003-0.009 mm.
2. Sigmas: chord 0.034-0.038 mm.









● **Sampling site**
Distribution

Toxadocia toxius (Topsent)

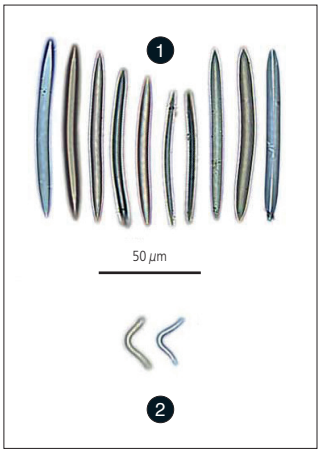
Synonyms:
Toxadocia toxius Thomas, 1986
Classification:

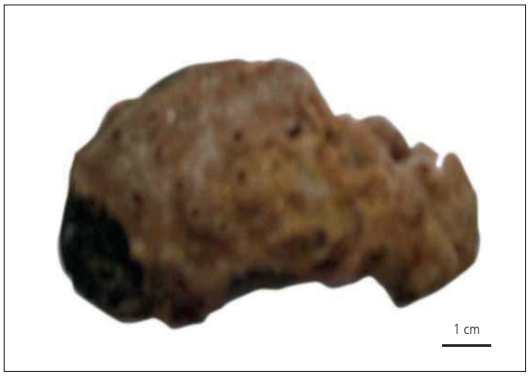
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Haplosclerida
Family	:	Adociidae
Genus	:	*Toxadocia*

General distribution: Red Sea, Indo-Australian
Distribution in the study area: Vizhinjam

Characteristic features:
- Maximum width of specimen: 80 mm.
- Maximum height of specimen: 41 mm
- Colour: black-brown when alive.
- Texture: soft, however hard when dry.
- Sponge encrusting on mussel.
- Surface hispid due to the presence of erect spicules.
- Oscules scattered; oscule diameter 0.5 to 2.0 mm.
- Pores not traceable.
- The main skeleton is rectangularly meshed, each side of the mesh is formed of one spicule.
- Spongin present only at the corners.

Spicules:
1. Oxeas: size 0.07-0.087 x 0.002-0.007 mm.
2. Toxas: size 0.019-0.04 x 0.002 mm.





Petrosia similis Ridley and Dendy

Synonyms:

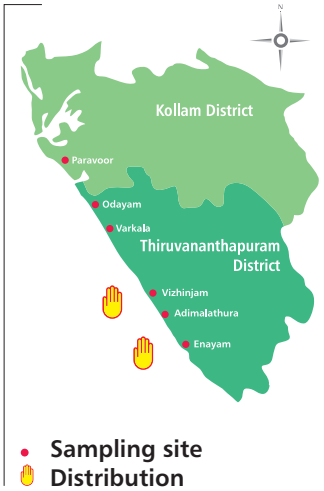
Petrosia similis Dendy, 1905; Thomas, 1986

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Haplosclerida
Family	:	Adociidae
Genus	:	*Petrosia*

General distribution: Indo-Australian and Antarctic

Distribution in the study area: Enayam and Vizhinjam.

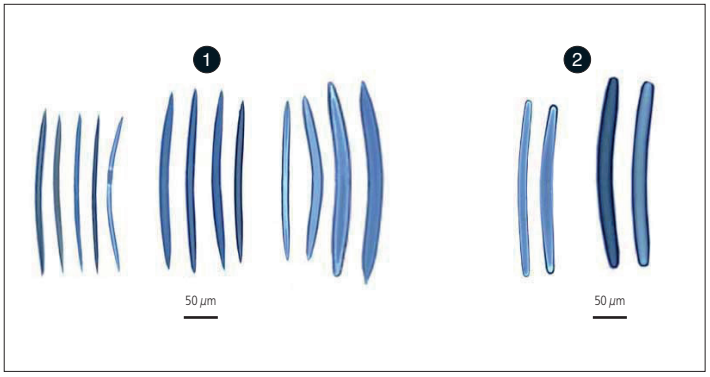


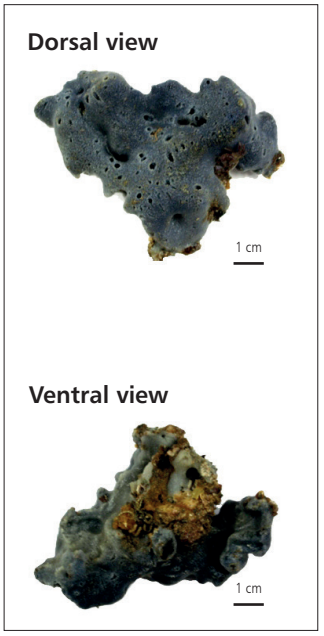
Characteristic features:

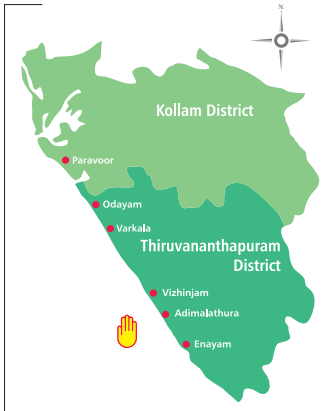
- Maximum width of specimen: 130 mm.
- Maximum height of specimen: 95 mm
- Colour: purplish blue when alive.
- Texture: hard and incompressible.
- Sponge thick, surface irregularly ridged.
- Oscules scattered; oscule diameter 0.5 to 2.0 mm.
- Pores minute.
- Surface hispid due to the presence of terminal parts of the main fibres.

Spicules:

1. Oxeas: size 0.2-0.34 x 0.011-0.027 mm.
2. Strongyles: size 0.2-0.3 x 0.02-0.03 mm.







- **Sampling site**
- **Distribution**

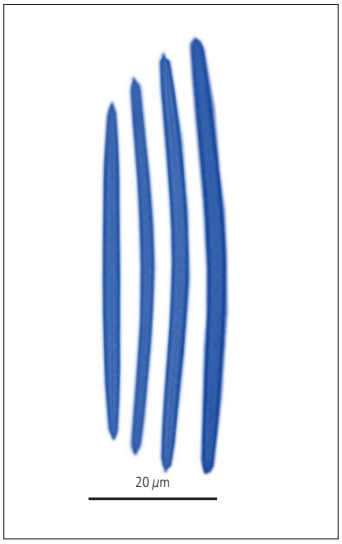
Callyspongia diffusa (Ridley)

Synonyms:
Callyspongia diffusa Burton, 1937;
Thomas, 1986

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Haplosclerida
Family	:	Callyspongiidae
Genus	:	Callyspongia

General distribution: Indo-Pacific.
Distribution in the study area: Adimalathura



Characteristic features:

- Maximum width of specimen: 41 mm
- Maximum height of specimen: 37 mm
- Colour: pale yellow when alive.
- Sponge erect, tubular or flabellate, branches 5-10 mm in diameter.
- Consistency: compressible with good resiliency.
- The specimens show a tendency to incorporate pebbles etc. into their body.
- Oscules scattered irregularly or marginal and serial; diameter upto 5 mm and compound.
- Pores minute, one per mesh.
- Surface reticulated and hispid; this hispidity is due to the presence of vertically arranged oxeas from the surface.
- Main fibres and connectives are quite distinct. The main fibres are coarse and multispicular; diameter up to 0.1 mm.
- Connectives are also multispicular, diameter up to 0.05 mm.

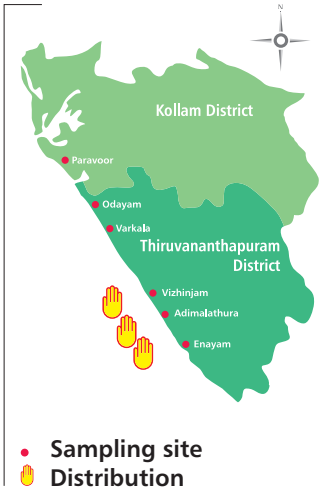
Spicules:
Oxeas: size 0.063-0.118 x 0.002-0.009 mm.

Callyspongia fibrosa (Ridley & Dendy)

Synonyms:
Pachychalina spinilamella Dendy, 1905
Sclerochalina spinilamella Burton, 1930
Callyspongia fibrosa Thomas, 1968

Classification:

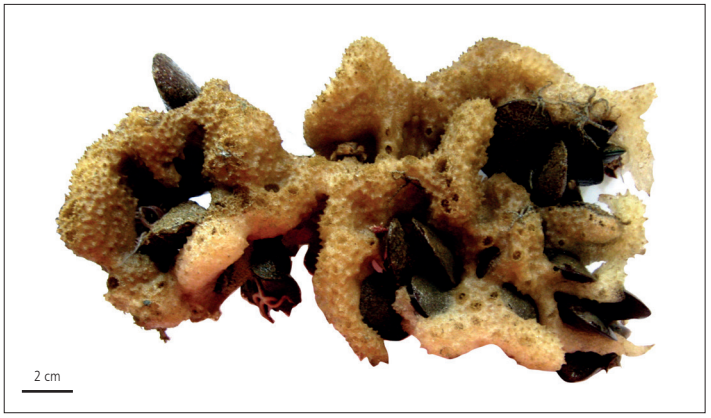
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Haplosclerida
Family	:	Callyspongiidae
Genus	:	*Callyspongia*

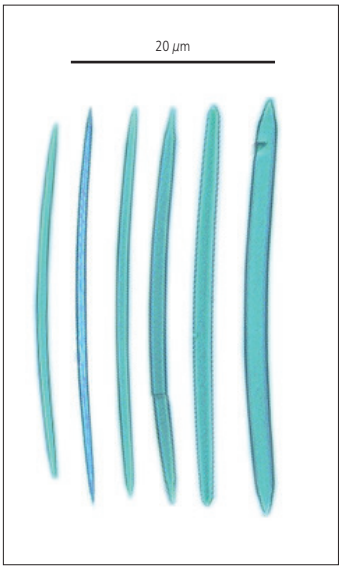


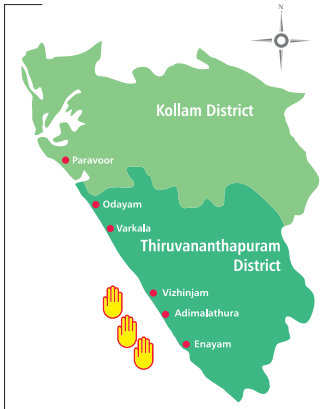
General distribution: Indo-Australian.
Distribution in the study area: Enayam, Adimalathura and Vizhinjam

Characteristic features:
- Maximum width of specimen: 92 mm.
- Maximum height of specimen: 42 mm
- Colour: pale yellow when alive.
- Sponge composed of finger-shaped/flattened branches; surface with strong conules, conules prominent at growing tips.
- Oscules irregularly distributed, terminal or marginal, rounded or elliptical, shallow and compound; oscule diameter 1 to 4 mm.

Spicules:
Oxeas: straight or slightly curved, tips abruptly pointed, size 0.08-0.11 x 0.002-0.007 mm.







- **Sampling site**
- **Distribution**

Callyspongia reticutis var. *salomonensis* Dendy

Synonyms:

Ceraochalina reticutis Dendy, 1905

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Haplosclerida
Family	:	Callyspongiidae
Genus	:	Callyspongia

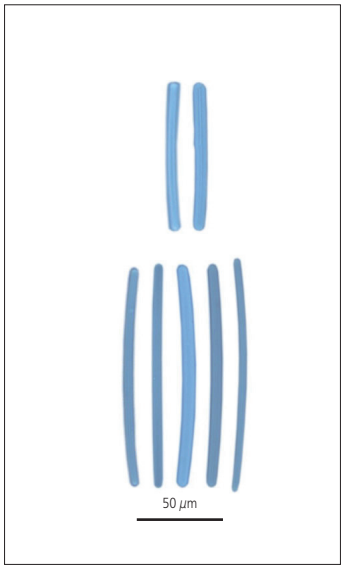
Distribution in the study area: Enayam, Adimalathura and Vizhinjam

Characteristic features:

- Maximum width of specimen: 74 mm.
- Maximum height of specimen: 42 mm.
- Colour: pale orange when alive.
- Texture: soft
- Sponge has a clathrous or lamellar body.
- Oscules are prominent and scattered; oscule diameter up to 2.0 mm; compound, arranged on one side in lamellar specimens.
- Dermal skeleton finely reticulate, dia. from 0.012-0.028 mm, cored uni or biserially.
- Main skeleton a network of primaries and connectives, diameter of primaries from 0.04-0.06 mm and are cored by 3-5 spicules in cross section.

Spicules:

Stongyles: size 0.08-0.135 x 0.003-0.009 mm.

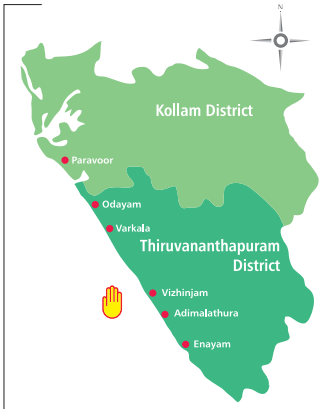


Plocamilla mannarensis (Carter)

Synonyms:
Dictyocylindrus manaarensis Carter, 1880;
Plocamia manaarensis Dendy, 1905;
Plocamilla manaarensis Thomas, 1986.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Plocamiidae
Genus	:	*Plocamilla*



Sampling site
Distribution

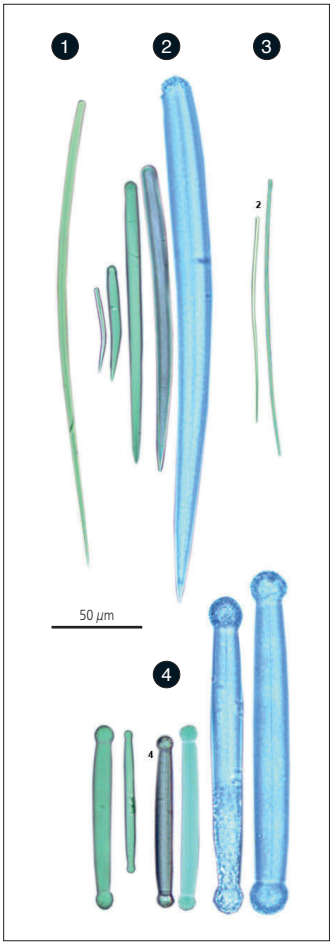
General distribution: Widely distributed in the Indian Ocean.
Distribution in the study area: Vizhinjam

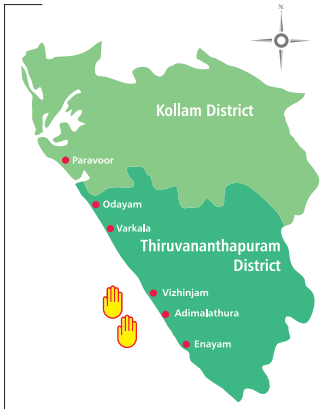
Characteristic features:

- Maximum width of specimen: 101 mm.
- Maximum height of specimen: 57 mm.
- Colour: brick red when alive.
- Texture: leathery consistency.
- Sponge pedunculate, bearing a number of branches; the diameter of branches 2 to 4 mm and their tips pointed.
- Oscules and pores not visible.
- The skeleton is divisible into axial and extraaxial parts. The extraaxial reticulation is divisible into primaries and connectives and are cored by styles and tylotes.

Spicules:

1. Styles (long): 0.519 x 0.011 mm.
2. Stout styles: 0.22-0.34 x 0.013 mm.
3. Slender styles: 0.22 x 0.003 - 0.004 mm.
4. Tylotes: head inflated and spiny, size 0.158-0.188 x 0.017-0.019 mm.
5. Toxas and chelas: rare and were not found in the present specimen.





● **Sampling site**
Distribution

Myxilla arenaria Dendy

Synonyms:

Myxilla arenaria Dendy, 1905

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Myxillidae
Genus	:	*Myxilla*

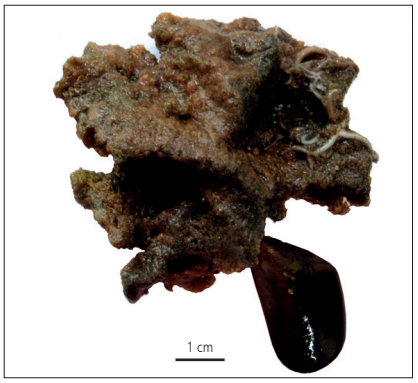
General distribution: Widely distributed in the Indian Ocean.
Distribution in the study area: Adimalathura and Vizhinjam

Characteristic features:

- Maximum width of specimen: 71 mm.
- Maximum height of specimen: 48 mm
- Colour: brownish with yellow tinge when alive.
- Texture: hard.
- Sponge massive with sand grains heavily incorporated.
- Oscules scattered; oscule diameter 0.5 to 1.0 mm.
- Pores not traceable.
- Surface rough and uneven.
- Dermal skeleton tangential, stongyles and microscleres are irregularly scattered.
- The main skeleton consists of an agglutination of sand grains united by films of spongin.

Spicules:

1. Strongyles: size 0.10-0.14 x 0.002-0.004 mm.
2. Acanthostyles: size 0.06-0.069 x 0.003-0.006 mm.
3. Isochelas: size 0.015-0.03 mm chord.
4. Sigmas (medium size): chord, 0.013-0.034 mm. Sigmas (large): chord, 0.051-0.057 mm.



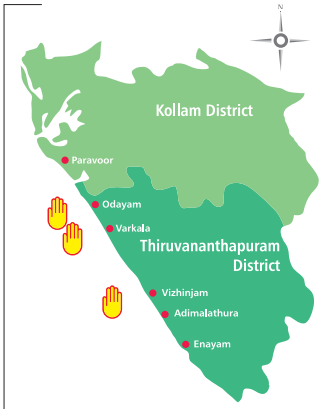
Aulospongus tubulatus (Bowerbank)

Synonyms:
Aulospongus tubulatus Dendy, 1905;
Burton, 1937; Thomas, 1986

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Raspailiidae
Genus	:	*Aulospongus*

General distribution: Widely distributed in the Indian Ocean.
Distribution in the study area: Vizhinjam, Varkala and Odayam

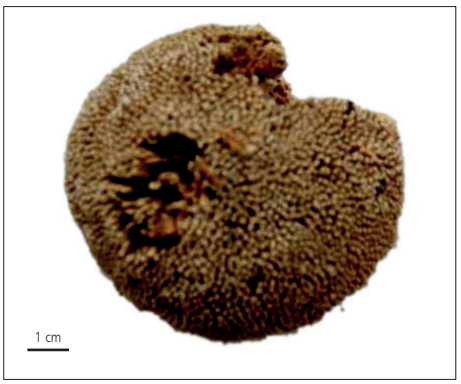


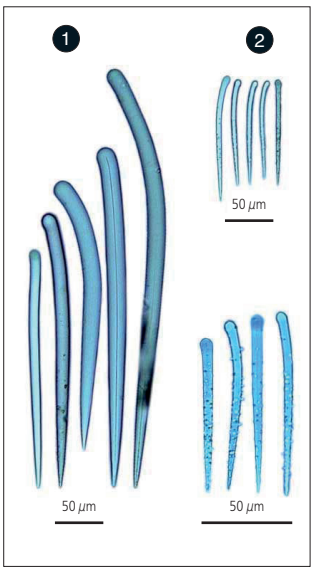
Characteristic features:

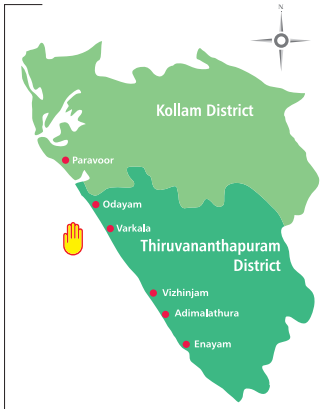
- Maximum width of specimen: 77 mm.
- Maximum height of specimen: 62 mm
- Colour: brick-red when alive.
- Texture: hard and incompressible.
- Sponge thickly encrusting when young, later as growth proceeds, becomes massive or massively lobose.
- Oscules scattered, diameter 1 mm.
- Surface conulose, conules rather flat and blunt.
- Skeleton consists of stout fibres radiating towards the surface. These fibres may be interconnected with either solitary spicules or irregular bundles of spicules.
- Spicules are plumosely arranged on these fibres.
- Spongin may be seen in appreciably good quantities.

Spicules:

1. Styles or sub-tylostyles: base hocky stick-like; size 0.25-0.47 x 0.013-0.022 mm.
2. Acanthostyles: basally curved; size 0.082-0.11 x 0.006-0.007 mm (four magnified spicules are also given).







● **Sampling site**
✋ **Distribution**

Endectyon fruticosa (Dendy)

Synonyms:
Raspailia fruticosa var. *tenuiramosa* Dendy, 1905
Endectyon fruticosa Thomas, 1986

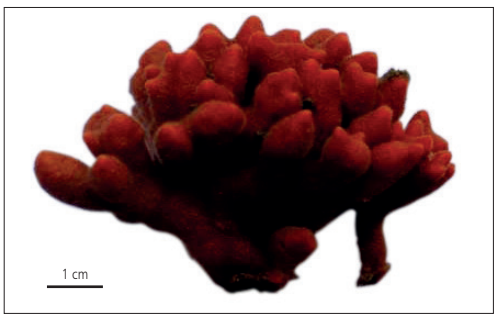
Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Raspailiidae
Genus	:	*Endectyon*

General distribution: Indo-Australian.
Distribution in the study area: Varkala

Characteristic features:
- Maximum width of specimen: 47 mm
- Maximum height of specimen: 40 mm
- Colour: brick-red when alive.
- Consistency: hard and leathery.
- Sponge stalked with finger-like branches growing in a bushy pattern; branches 3-5 mm in diameter.
- Oscules small; diameter 0.5 to 1 mm.
- Surface hispid and velvety.
- Skeleton arrangement is in an axinellid pattern. The axial part is dense and compact, extra axial fibres arise in an oblique manner from the axial part. The extra axial fibres are inter-connected in a scalariform pattern.
- Spicules are arranged in a plumose pattern in these fibres and are echinated by acanthostyles (graphnel spicules).

Spicules:
1. Stout styles: size 0.220-0.301 x 0.009-0.014 mm.
2. Long styles: 0.301-0.637 x 0.005 mm.
3. Acanthostyles: "Graphnel" type, size 0.121-0.137 x 0.006-0.011 mm (at the widest part of the spicule)



Clathria frondifera (Bowerbank)

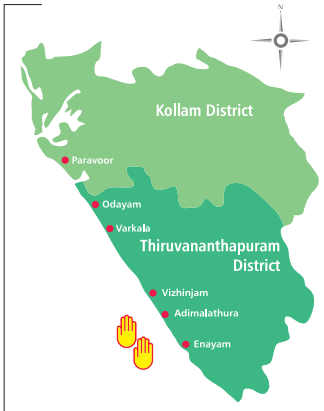
Synonyms:

Clathria frondifera Burton, 1937; Thomas, 1986

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Ophlitaspongiidae
Genus	:	*Clathria*

General distribution: Red Sea to Australian region.
Distribution in the study area: Enayam and Adimalathura



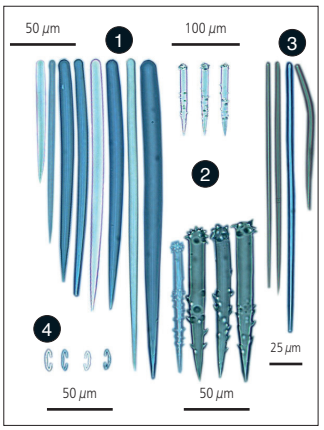
Sampling site
Distribution

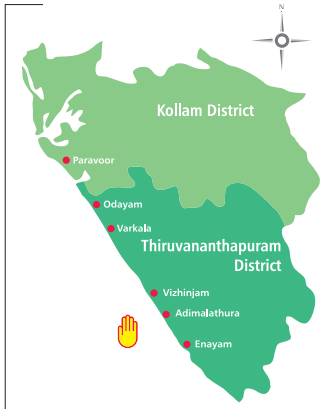
Characteristic features:

- Maximum height of specimen: 67 mm.
- Colour: brick-red when alive.
- Texture: firm and compressible.
- Sponge consists of a clathrous mass of flattened or rounded trabeculae.
- Oscules and pores are not traceable.
- Skeleton is a reticulation of fibres cored and echinated by styles and acanthostyles.
- Two types of subtylostyles are present, the larger one interstitially and smaller, in the dermal part.

Spicules:

1. Styles: size 0.164-0.338 x 0.003-0.010 mm.
2. Acanthostyles: size 0.104-0.115 x 0.011 mm; more magnified (bottom).
3. Subtylostyles: size 0.09-0.23 x 0.005-0.013 mm.
4. Isochelas, palmate: chord, 0.012-0.016 mm.
5. Toxas (hair-like): not seen





● **Sampling site**
✋ **Distribution**

Clathria procera (Ridley)

Synonyms:
Clathria procera Burton, 1937;
Thomas, 1986.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Ophlitaspongiidae
Genus	:	*Clathria*

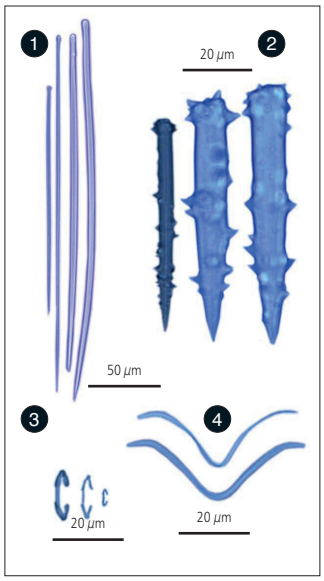
General distribution: Red Sea to Australian region.
Distribution in the study area: Adimalathura.

Characteristic features:

- Maximum width of specimen: 108 mm.
- Maximum height of specimen: 70 mm.
- Colour: red in colour when alive.
- Texture: stiff but slightly compressible.
- Sponge found attached to brown mussels.
- Sponge a clathrous mass of flattened branches which are divisible into main and connecting branchlets. Branches about 10-15 mm wide and divide dichotomously.
- Surface uneven.
- Oscules scattered; slit-like; oscule diameter up to 1.0 mm.
- Skeleton is an irregular reticulation of well developed fibres, cored by subtylostyles and echinated by acanthostyles.

Spicules:

1. Subtylostyles: Main, size 0.211-0.355 x 0.008-0.014 mm; Interstitial, basally spined, size 0.184-0.299 x 0.004-0.008 mm; Dermal, size 0.166 x 0.004 mm
2. Acanthostyles: size, 0.048-0.072 x 0.004-0.009 mm.
3. Isochelas: size, chord up to 0.016 mm.
4. Toxas: Hair-like, size, 0.042 mm

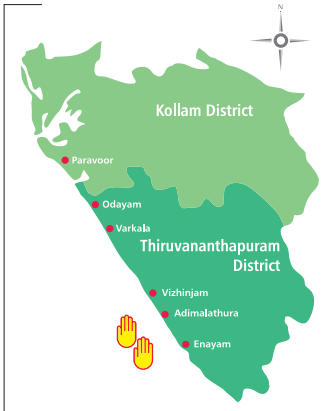


Mycale mytilorum Annandale

Synonyms:
Mycale mytilorum Burton, 1937; Thomas, 1986
Classification:

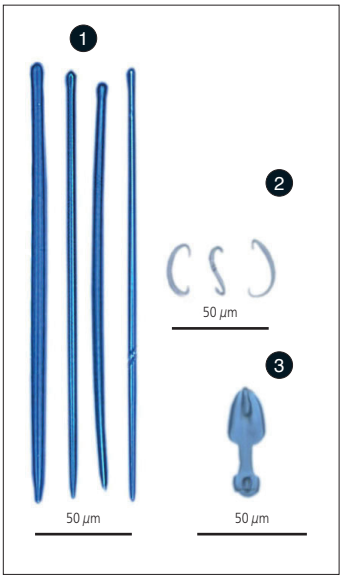
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Ophlitaspongiidae
Genus	:	*Mycale*

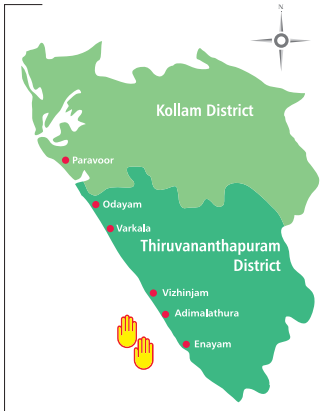
General distribution: Widely distributed in the Indian Ocean.
Distribution in the study area: Enayam and Adimalathura



Characteristic features:
- Maximum spread of specimen: 48.0 mm.
- Colour: brick-red when alive.
- Texture: slimy when alive with good resiliency.
- Sponge encrusting or massive
- Surface even.
- Oscules few, present only on the thickest part.
- Pores minute, oval in outline, highly contractile.
- Subtylostyles are scattered in the dermal region along with microscleres.
- Main skeleton irregular.

Spicules:
1. Subtylostyles: size 0.21-0.227 x 0.003-0.008 mm.
2. Sigmas: chord size 0.03-0.05 mm.
3. Anisochelas: chord, 0.012-0.021 mm.





● **Sampling site**
Distribution

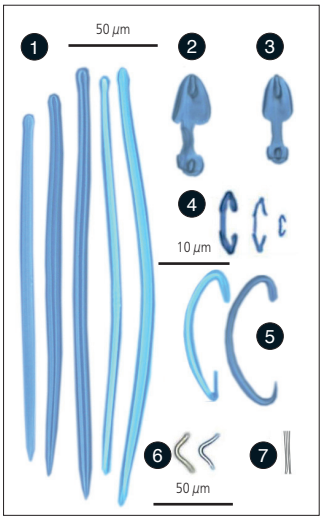
Zygomycale parishii (Bowerbank)

Synonyms:
Esperella parishii Dendy, 1905
Mycale parishii Burton and Rao, 1932
Zygomycale parishii Thomas, 1986

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Ophlitaspongiidae
Genus	:	*Zygomycale*

General distribution: Tropical Atlantic Ocean, Australian region and Pacific
Distribution in the study area: Enayam and Adimalathura

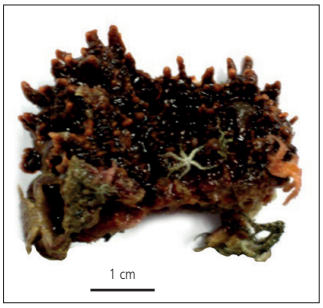


Characteristic features:

- Maximum width of specimen: 35 mm.
- Maximum height of specimen: 53 mm
- Colour: golden yellow when alive.
- Texture: compressible when fresh, becomes hard on drying. Sponge encrusting, irregularly branched or even massively clathrous.
- Oscules scattered; oscule diameter up to 1.5 mm.
- Pores in between meshes, in groups of 4 to 7. Surface conulose and corrugated. Dermal skeleton consists of a well developed reticulation of fibres or spicules scattered horizontally without any specific order.
- Main skeleton fibrous and the meshes are irregular in shape.

Spicules:

1. Subtylostyles or styles: size 0.212-0.372 x 0.002-0.008 mm.
2. Large anisochelas: chord size 0.04-0.043 mm.
3. Small anisochelas: average chord size 0.022 mm.
4. Isochelas: chord 0.01 mm, rare
5. Sigmas: Two types are present and measure 0.065-0.09 mm and 0.013-0.039 mm respectively.
6. Toxas: size 0.033-0.084 mm
7. Raphides: In groups, individual size 0.015-0.029 mm, hair-like.

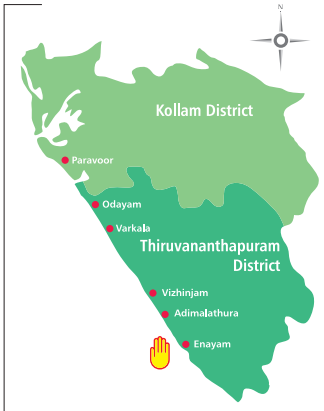


Aulenella foraminifera Burton & Rao

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Poecilosclerida
Family	:	Microcionidae
Genus	:	*Aulenella*

General distribution: Indonesian Exclusive Economic Zone, Indian seas.
Distribution in the study area: Enayam

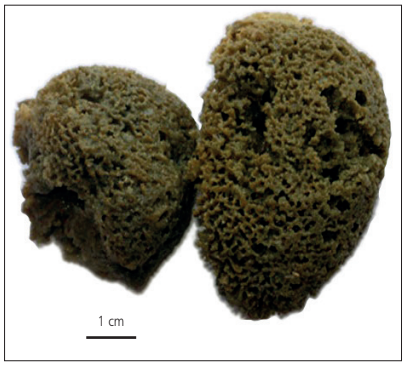


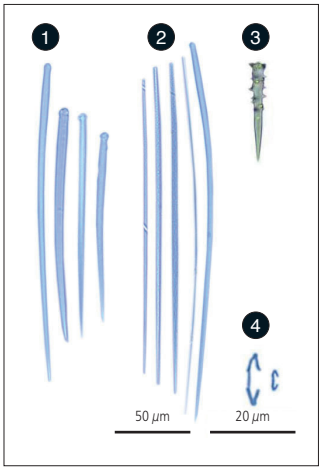
Characteristic features:

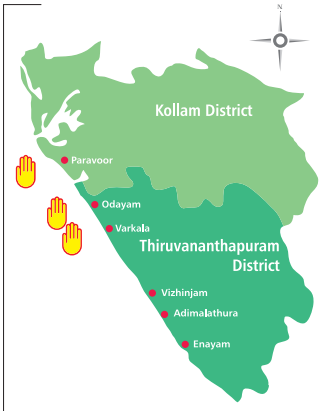
- Maximum width of specimen: 52 mm.
- Maximum height of specimen: 30 mm.
- Colour: bright red when alive, greyish yellow in spirit.
- Texture: slightly compressible.
- Sponge massive, tennis ball-like, formed of honeycomb-like tuberculae.
- Surface minutely hispid.
- Skeleton is an irregular reticulation of spongin fibres cored by foreign particles and echinated by numerous acanthostyles and occasionally by basally tuberculated tylostyles.
- Dermal skeleton absent.
- Oscules scattered; oscule diameter up to 2 mm.

Spicules:

1. Tylostyles: 0.196-0.373 x 0.002-0.003 mm
2. Subtylostyles: size 0.126-0.211 x 0.003 mm.
3. Acanthostyles: 0.12 x 0.012 mm.
4. Chelas: chord 0.016-0.032 mm.







● **Sampling site**
✋ **Distribution**

Axinella donnani (Bowerbank)

Synonyms:
Isodictya donnani Bowerbank, 1873;
Phakettia donnani Dendy, 1905;
Axinella donnani Burton, 1937;
Thomas, 1970

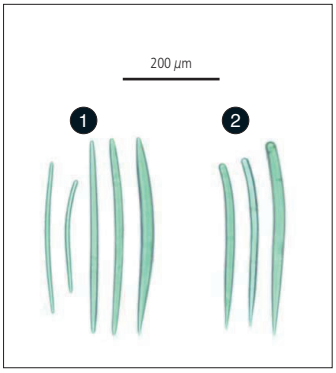
Classification:

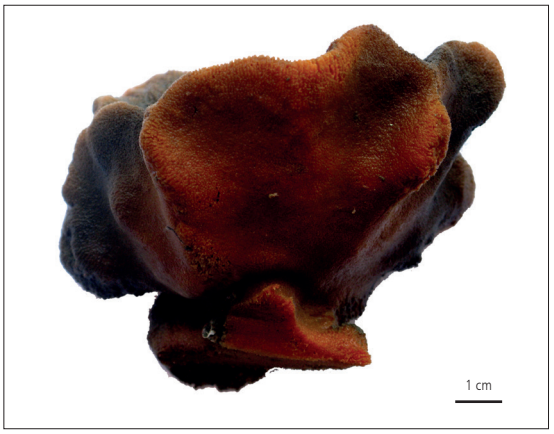
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Halichondrida
Family	:	Axinellidae
Genus	:	*Axinella*

General distribution: Atlantic Ocean, Red Sea.
Distribution in the study area: Varkala, Odayam and Paravoor.

Characteristic features:
- Maximum width of specimen: 102 mm.
- Maximum height of specimen: 71 mm.
- Colour: orange in colour when alive.
- Texture: slightly hard.
- Sponge lamellar; lamellae branched and cup-shaped.
- Surface minutely hispid with longitudinal ridges at the growing tips.
- Oscules scattered; oscule diameter 0.5 mm.
- Pores minute.

Spicules:
1. Oxeas: size 0.3-0.45 x 0.008 mm.
2. Styles: size 0.33-0.38 x 0.011-0.025 mm





Trachyopsis halichondroides Dendy

Synonyms:

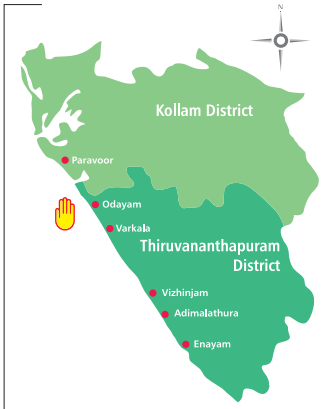
Trachyopsis halichondroides Dendy, 1905.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Halichondrida
Family	:	Halichondriidae
Genus	:	*Trachyopsis*

General distribution: Red Sea to The Philippines.

Distribution in the study area: Odayam

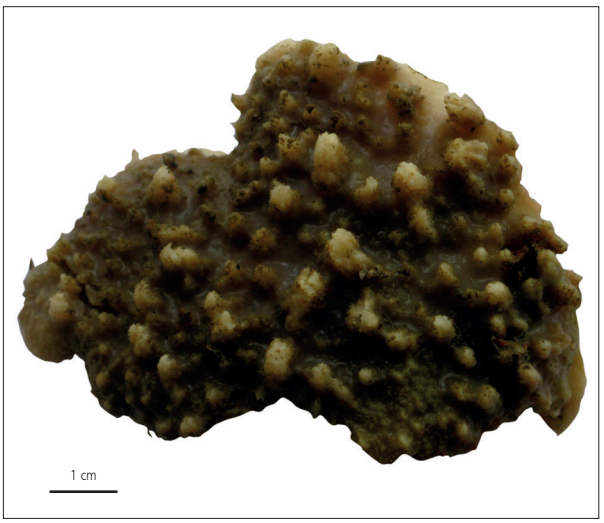


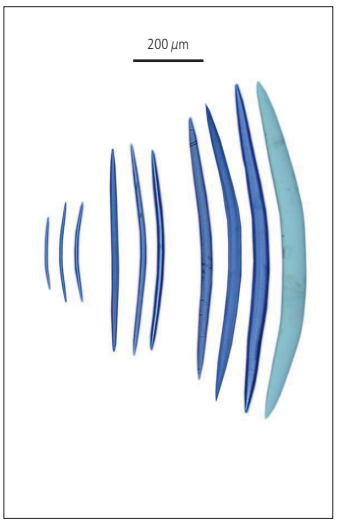
Characteristic features:

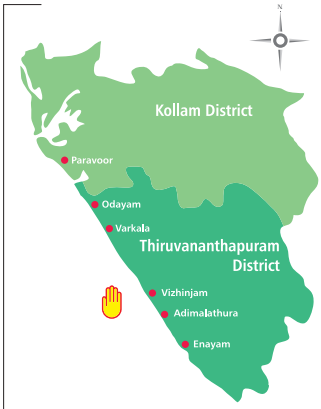
- Maximum width of specimen: 82 mm.
- Maximum height of specimen: 37 mm.
- Colour: yellowish-grey when preserved in alcohol.
- Texture: compressible.
- Sponge massive with finger shaped branches arising from the upper parts.
- Oscules found at the tip of branches; oscule diameter 2-5 mm.
- Main skeleton is an irregular reticulation of oxeas.
- Smaller oxeas are present in the dermal part.

Spicules:

Oxeas: size 0.2-0.9 x 0.035 mm (maximum).







● **Sampling site**
Distribution

Cliona celata Grant

Synonyms:
Cliona celata Thomas, 1986.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Hadromerida
Family	:	Clionidae
Genus	:	*Cliona*

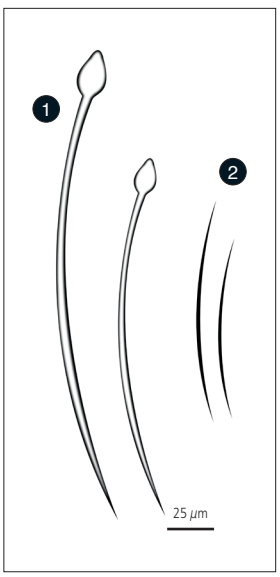
General distribution: Cosmopolitan.
Distribution in the study area: Vizhinjam

Characteristic features:

- This is a boring sponge, common on calcareous structures like shell, coral, calcareous algae, test of barnacles etc.
- The excurrent and incurrent papillae project out of the substratum in living condition; but these are highly contractile and only the pores on the substratum may be visible when taken out of water. These pores on shell may vary from 0.5-2.0 mm in diameter.
- The larger pores accommodate excurrent and smaller accommodate the incurrent papillae.
- Colour: papillae vary from green to golden yellow or even red in living condition.

Spicules:

1. Tylostyles: size 0.150-0.33 x 0.006-0.013 mm.
2. Oxeas: Hair-like, size 0.147-0.203 mm.



Cliona vastifica Hancock

Synonyms:

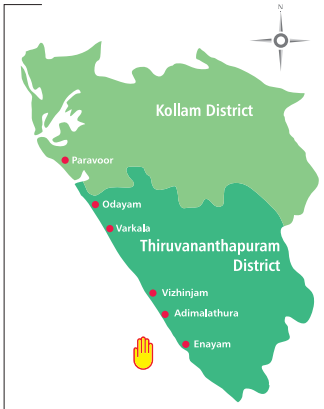
Cliona vastifica Thomas, 1972; Thomas,1986.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Hadromerida
Family	:	Clionidae
Genus	:	*Cliona*

General distribution: Cosmopolitan; this species is capable of tolerating lower salinities and hence very common in the estuaries.

Distribution in the study area: Enayam

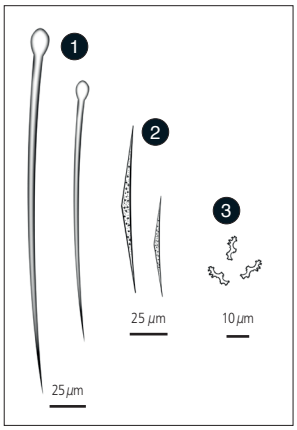


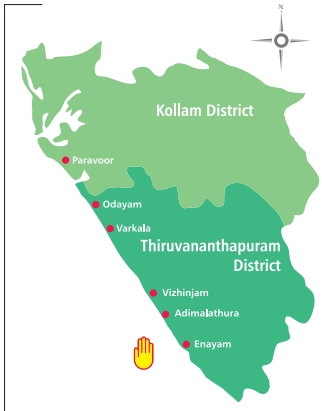
Characteristic features:

- This is a common boring sponge infesting all calcareous objects.
- They infest on the shells with smaller openings and the diameter may vary from 0.5 to 1.0 mm.
- On thin shells, the openings may be in a linear and reticulated pattern, but on thick shells, they may be irregularly distributed.
- In living condition, the papillae may project out through the openings at the surface of the shell.
- Colour: papillae may be yellow or pale grey in living condition.
- Cavities formed inside the shell up to 1.5 mm, but subject to considerable variation.

Spicules:

1. Tylostyles: size 0.157-0.294 x 0.001-0.007 mm.
2. Oxeas: Microspined and with prominent spines at the central part or even uniformly smooth, size 0.042-0.142 x 0.002-0.006 mm.
3. Spirasters with 2-6 angulations: size 0.008-0.021 x 0.001-0.002 mm.





● **Sampling site**
Distribution

Pseudosuberites andrewsi Kirkpatrick

Synonyms:
Pseudosuberites andrewsi Burton, 1937;
Thomas, 1986.

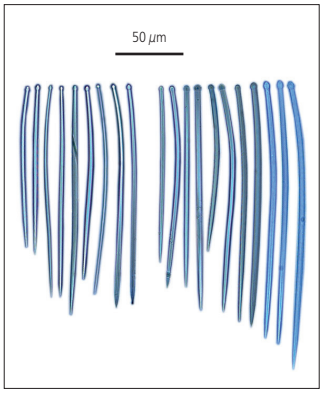
Classification:

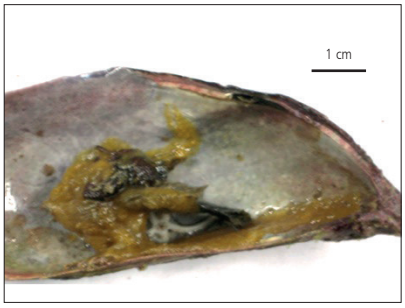
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Hadromerida
Family	:	Suberitidae
Genus	:	*Pseudosuberites*

General distribution: Indo-Australian.
Distribution in the study area: Enayam

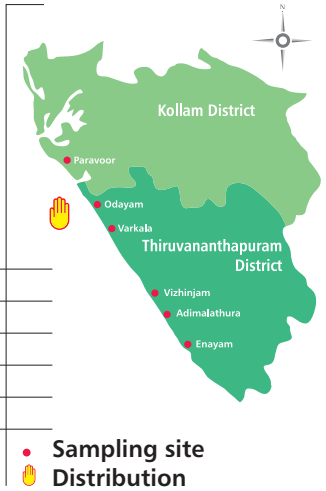
Characteristic features:
- Maximum width of specimen: 50 mm.
- Maximum height of specimen: 15 mm.
- Colour: pale yellow when alive.
- Texture: compressible when fresh, friable in dry condition.
- Sponge encrusting on hard objects.
- Surface smooth when alive, but pitted in dry condition.
- Oscules scattered, 1-2 mm in diameter.
- Pores small and irregular.

Spicules:
Tylostyles: size 0.147-0.354 x 0.004-0.009 mm.





Prostylissa foetida (Dendy)



Synonyms:
Prostylyssa foetida Burton, 1937;
Thomas, 1986.

Classification:

Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Epipolasida
Family	:	Jaspidae
Genus	:	*Prostylyssa*

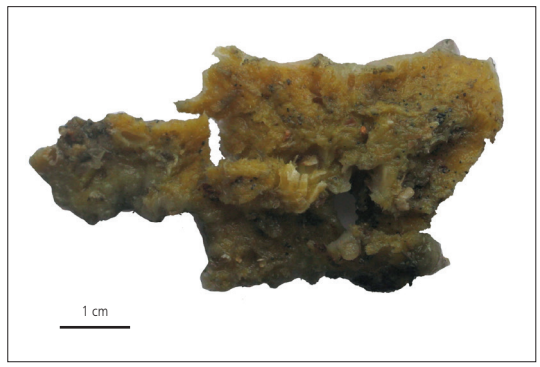
General distribution: Indo-Australian.
Distribution in the study area: Odayam

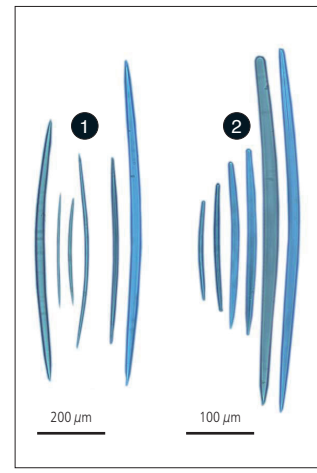
Characteristic features:

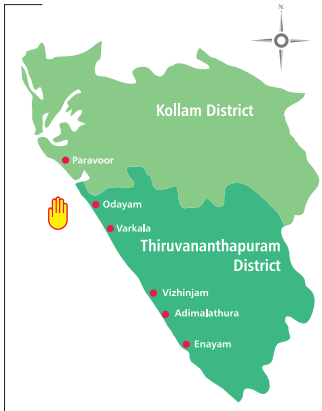
- Maximum width of specimen: 33 mm.
- Maximum height of specimen: 14 mm.
- Colour: pale green externally and pale white internally when alive.
- Texture: hard and slightly compressible.
- Sponge encrusting.
- Oscules scattered, diameter 1-3 mm and compound.
- Surface minutely hispid and reticulated.
- Dermal skeleton of oxeas in reticulation, ornamented with small styles.
- Main skeleton is a dense reticulation of oxeas; spongin content is sparse.

Spicules:

1. Oxeas: size 0.26-0.83 x 0.006-0.02 mm.
2. Styles: size 0.14-0.24 x 0.01 mm.







● **Sampling site**
✋ **Distribution**

Epipolasis topsenti (Dendy)

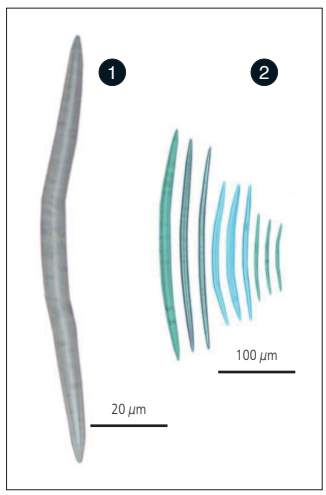
Synonyms:
Spongosorites topsenti Dendy, 1905;
Epipolasis topsenti Thomas, 1986.

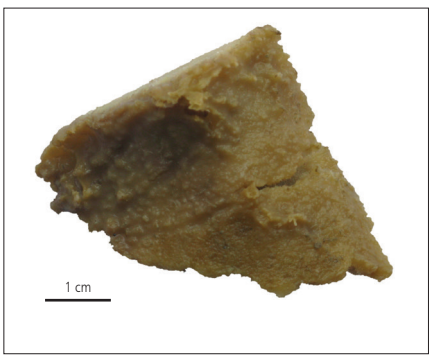
Classification:

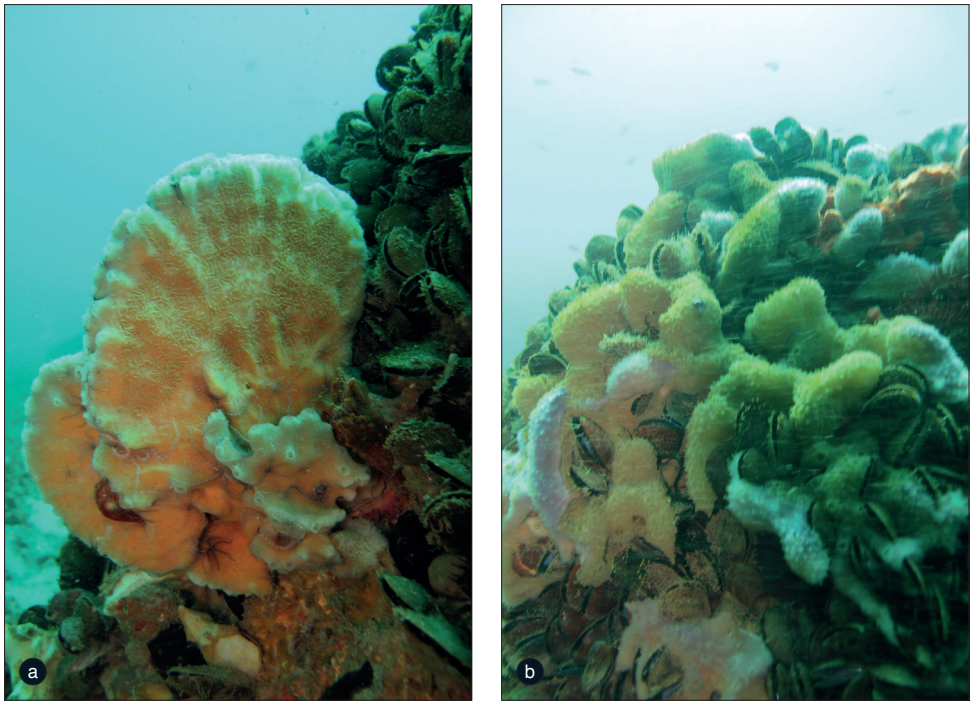
Kingdom	:	Animalia
Phylum	:	Porifera
Class	:	Demospongiae
Order	:	Epipolasida
Family	:	Sollasellidae
Genus	:	*Epipolasis*

General distribution: Indo-Australian.
Distribution in the study area: Odayam

Characteristic features:
Maximum width of specimen: 36 mm.
Maximum height of specimen: 24 mm.
Colour: yellow.
Texture: hard.
Sponge tuberous, surface even but microscopically hispid.
Oscules and pores not traceable.
Dermal skeleton well developed; small oxeas are arranged irregularly in the dermal part.
Main skeleton in ill defined bands.
Spongin scarcely present.
Spicules:
1. Oxeas: size up to 1.1 x 0.059 mm.
2. Small oxeas: size 0.16-0.24 x 0.004-0.006 mm.







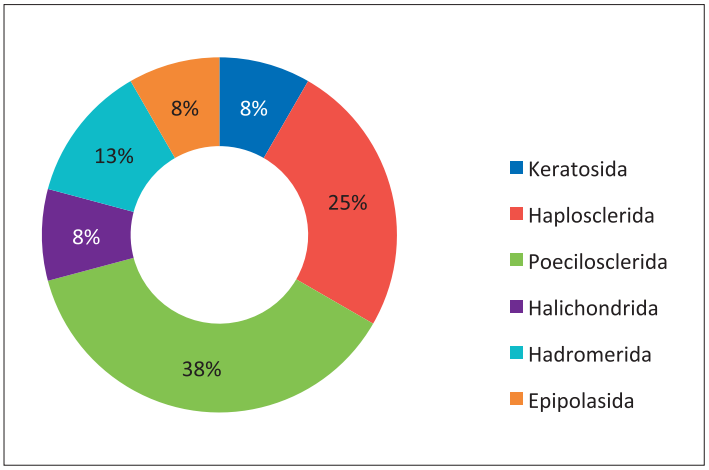
Underwater photographs of (a) *Sigmadocia carnosa* and (b) *Callyspongia fibrosa* in the mussel beds at Vizhinjam

The total number of sponge species recorded during the present study is far less when compared to the sponges distributed in the Gulf of Mannar and the Palk Bay region (319 species), the Andaman & Nicobar Islands (95 species) and the Lakshadweep Islands (91 species) as shown in the works of Venkataraman and Wafar (2005) and Thomas (1986, 1989).

Structure, composition and distribution of sponges

The order-wise percentage distribution of sponges identified from the study locales showed that the Order Poecilosclerida had the highest species composition (37.5%), followed by Haplosclerida (25.0%) and Hadromerida (12.5%). The Orders Keratosida, Halichondrida and Epipolasida had a composition of 8.33% species each.

Table 3 shows the distribution and species richness of sponges in six stations. The maximum species diversity was recorded at Enayam (11 species), followed by an equal number of species at Vizhinjam and Adimalathura (10 species each). Five species of sponges were recorded at Odayam while three species were recorded at Varkala and only one at Paravoor. The stations Enayam, Vizhinjam and Adimalathura are characterized by patches of corals, rocky stretches and extensive mussel



Percentage distribution of sponge species in different orders

Table 3. Distribution of sponges in the study area

Sl. No.	Species	Enayam	Vizhinjam	Adimalathura	Varkala	Odayam	Paravoor
1	*Ircinia fusca*	+	-	+	-	-	-
2	*Spongia* sp.	-	+	-	-	-	-
3	*Sigmadocia carnosa*	+	+	+	-	-	-
4	*Toxadocia toxius*	-	+	-	-	-	-
5	*Petrosia similis*	+	+	-	-	-	-
6	*Callyspongia diffusa*	-	-	+	-	-	-
7	*Callyspongia fibrosa*	+	+	+	-	-	-
8	*Callyspongia reticutis var. salomonensis*	+	+	+	-	-	-
9	*Plocamilla mannarensis*	-	+	-	-	-	-
10	*Myxilla arenaria*	-	+	+	-	-	-
11	*Aulospongus tubulatus*	-	+	-	+	+	-
12	*Endectyon fruticosa*	-	-	-	+	-	-
13	*Clathria frondifera*	+	-	+	-	-	-
14	*Clathria procera*	-	-	+	-	-	-
15	*Mycale mytilorum*	+	-	+	-	-	-
16	*Zygomycale parishii*	+	-	+	-	-	-
17	*Aulenella foraminifera*	+	-	-	-	-	-
18	*Axinella donnani*	-	-	-	+	+	+
19	*Trachyopsis halichondroides*	-	-	-	-	+	-
20	*Cliona celata*	-	+	-	-	-	-
21	*Cliona vastifica*	+	-	-	-	-	-
22	*Pseudosuberites andrewsi*	+	-	-	-	-	-
23	*Prostylyssa foetida*	-	-	-	-	+	-
24	*Epipolasis topsenti*	-	-	-	-	+	-
	Total	11	10	10	3	5	1

beds which would probably be assisting in an easy settlement of the larval forms and better colonization of sponges. The reef patches are comparatively less at Odayam, Varkala and Paravoor which might be the reason for the poor diversity of sponge fauna.

An analysis of the diversity indices revealed that the Shannon diversity was high at Enayam, Vizhinjam and Adimalathura (Table 4) when compared to Varkala, Odayam and Paravoor.

The Bray Curtis Similarity Index showed two major groupings. While the stations Enayam, Vizhinjam and Adimalathura showed one cluster indicating similarity of species in these stations, the stations Varkala, Odayam and Paravoor showed another cluster, which could be due to the reason that these stations are far away from the former cluster and thus having a different species mix.

The present study has indicated that the stations Enayam, Vizhinjam and Adimalathura are rich in diversity of sponges when compared to Varkala, Odayam and Paravoor. However, depth-wise exploration in these regions should throw more light on their distribution, composition and diversity.

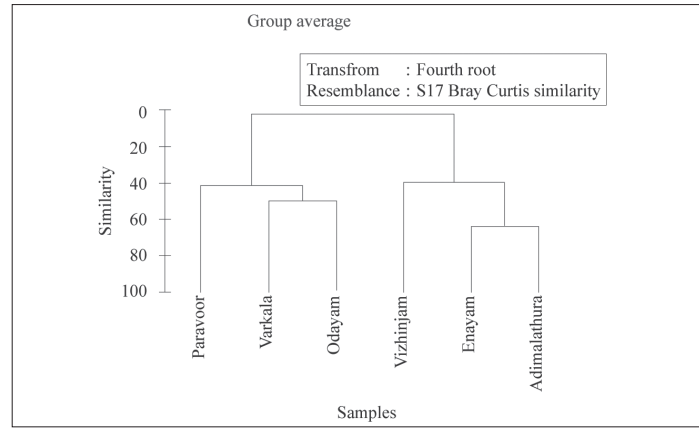
The coastal stretch of the south-west coast of India, especially from Kollam to Kanyakumari, is mostly rocky and affords a congenial habitat for the larvae of sedentary organisms to settle and flourish. Crevices of rocks, surfaces of cliffs, rocky outcrops in the intertidal zone, beds of brown mussel, etc. which are in plenty here, provide a rich abode for massive, encrusting and boring sponges.

Both the massive and encrusting sponges are richly distributed along the coast. The former type, after its initial encrusting phase grows to massive, lamellar, tubular or even clathrous form in advanced stages weighing 2 to 4 kg or even more, while the latter type retain the initial encrusting morphology throughout life. These encrusting species usually prefer the under surfaces of rocks away from direct sunlight. During surveys carried out by the 3rd author (Thomas, P.A.) and also by various

Table 4. Univariate diversity indices of sponges of different locations

Sample	S	N	d	J'	H'(log2)	1-Lambda'
Enayam	11	16	3.611	0.977	3.38	0.9578
Vizhinjam	10	14	3.449	0.973	3.232	0.9568
Adimalathura	10	18	3.102	0.9635	3.201	0.9335
Varkala	3	3	1.82	1	1.585	1
Odayam	5	5	2.485	1	2.322	1
Paravoor	1	1	****	****	0	****

S= total species; N= total individuals; J'= Pielou's evenness; H'= Shannon diversity; 1-Lambda'= Simpson diversity



Cluster analysis of different sampling stations from Enayam to Paravoor

research teams under the 'Drugs from the Sea' Project of MoEN / MoEF, New Delhi, sponge samples were collected from the southwest coast of India from 1990 onwards. These samples together with those collected by the same author (Thomas, P.A.) from the intertidal and raft-cultured molluscs (pearl oysters and mussel) at Vizhinjam Bay helped much in a systematic appraisal of the encrusting and boring sponge species occurring in this area totalling to 105 species (Thomas, P.A., personal communication). These include both massive and encrusting species with a ratio of 1:1. The sponge fauna of this area shows considerable similarity with that of the Gulf of Mannar. It is hoped that more and more species may emerge from this area when statistically designed surveys are made in future.

In view of the ecological and pharmacological importance of sponges, it is imperative to conduct surveys and investigations to understand the distribution and abundance of various species in our waters. The explorations would also help to unravel many species of sponges hitherto unknown to science.

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